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[Title Of The Invention]

MULTILAYER CERAMIC CIRCUIT BOARD

[Abstract]

PURPOSE: To increase the strength of a lowermost section layer, and to connect input/output pins and a board firmly by forming a layer, to which SiC whiskers are added, to the lowermost section layer to which the input-output pins are connected directly.

CONSTITUTION: A layer 10 fiber-reinforced with SiC whiskers is shaped to a lowermost section layers as input/output pin 4 connecting sections for a multilayer ceramic circuit board. Consequently, the strength of the lowermost section layer is increased. Accordingly, input/output pins and the board are connected solidly.

[Claim]

A multilayer ceramic circuit board having a layer strengthened by SiC whiskers in a lowermost section layer of input-output pins connection part.

[Detailed explanation of the invention]

This invention is related to a strengthening method of a multilayer ceramic circuit board, more particularly, to the multilayer ceramic circuit board that adhesion of input/output pins and the circuit board is strengthened by strengthening the lowermost section layer of input-output pins connection part by Sic whisker.

[Field of the invention]

The multilayer ceramic circuit board that can mount semiconductor in the high density is getting fine-patterned lately along with the high accumulation of the semiconductor device. Therefore, a method of forming input/output connecting pin in the high density and high adhesiveness on the substrate is needed.

[Prior Art]

The In a conventional I/O pin mounting method of a multilayer ceramic circuit board, I/O pin 4 is directly connected to the burned circuit board 1 as shown in the Fig. 1, and I/O pin hollows the circuit board as shown the dotted line A when breaking. It relates to the defect that the intensity of the circuit board is low. In other words, even if the power added at the tip of the I/O pin is small, the big power is added by the principle of the lever in the I/O pin mounting part, and damage occurs in the circuit board near I/O pin mounting part. This is brought about I/O pin mounting part on the multilayer ceramic circuit board which glass ceramics is used for.

On the relation between the material and the strength of the multilayer ceramic circuit board, the strength of the circuit board made of the glass ceramics which is not crystallized by heat treatment consisting of polysilicate glass and alumina has low strength about 1/3 of the strength of the circuit board made of only alumina.

[Problems to be solved]

To provide a multilayer ceramic circuit board having I/O pins with high reliability to prevent the damage of the I/O pin mounting part of the ceramic circuit board.

[Means for solving the problems]

A layer strengthened by SiC whiskers in a lowermost section layer of input-output pins

connection part is provided.

[Function]

In this invention, connection of the I/O pins and the circuit board is strengthened by strengthening the lowermost section layer of the circuit board by Sic whisker with high intensity.

[Embodiment]

An embodiment of the invention will be described with reference to the drawings.

Fig. 1 is the cross section of the multilayer ceramic circuit board forming Sic strengthening layer in the I/O pin mounting part.

1 is the glass ceramics layer where it was formed by burning of green sheet which makes alumina and the powder of silicic acid glass in the Fig. 1. 10 is the Sic whisker tempered glass ceramics layer where it was formed by burning of green sheet which makes alumina, silicic acid glass powder and a Sic whisker.

2 is a bonding pad formed in the I/O pin mounting part of the Sic whisker tempered glass ceramics layer. 3 is a brazing material such as Au-Sn, and 4 is a pin made of phosphor bronze with flange.

On the glass ceramics layer 1 made of the powder of alumina and the silicic acid glass can bond the IC chip 8 by methods such as a flip chip bonding. 5 is a bonding pad formed in the glass ceramics layer 1, and 7 is a bonding pad set up on the IC chip, and 6 is a brazing material.

Alumina powder ( $2\ \mu\text{m}$ ) 350g, the silicic acid glass powder ( $3\ \mu\text{m}$ ) 350g, polyvinyl butyral PVB 80g, dibutyl phthalate D.B.P. 40g, methyl ethyl ketone MEK 100g, and acetone 500g are kneaded by ball milling for 24 hours and get slurry.

A  $30\ \mu\text{m}$  green sheet is formed by doctor blade method after viscosity of the slurry is controlled 30 poise. The green sheet A is punched out 15mm. In addition, a green sheet added Sic whisker is formed 150 mm in the same way.

Through holes are formed, and a circuit pattern is formed on the green sheet A by Au, Ag, and Cu. 10 to 30 sheets of them are lapped and laminated 30Mpa. The green sheet B with Sic whisker is used at the lowermost layer. The laminated body is burned in N<sub>2</sub> or in the atmosphere at 950 degrees C for 3 hours, and a circuit board is made.

The brazing material of Au-Sn is applied on the circuit board, and the phosphor bronze I/O pin is adhered on the circuit board at 400 degrees C for 10 minutes.

And, as for the amount of Sic to add it in the raw material of green seat B, it is preferable to be 5 to 33 weight part while Alumina powder and the silicic acid glass powder is 100 weight part. The the strength improvement is not effective less than 5 weight part, and sintering performance is poor more than 33 weight part and the strength is reduced.

The adherence strength of the pin is examined by a conventional method and a method having the glass ceramic strengthening layer added Sic whisker of this invention, and the result below is found.

	Adherence strength (Mpa)
This invention	50
Conventional method	20

[Effect of the invention]

By forming the layer added Sic Whisker on the lowermost layer which connects directly to the I/O pin to strengthen the adhesion of the I/O pin and the circuit board, the strength

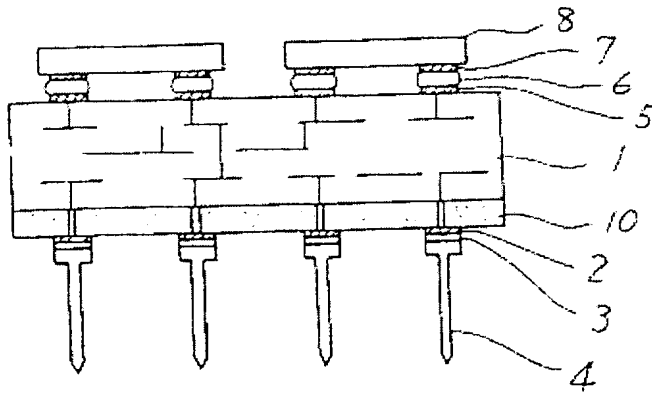
of the lowermost layer is enhanced, and the adhesion of the I/O pin and the circuit board is strengthened.

[Brief explanation of the drawing]

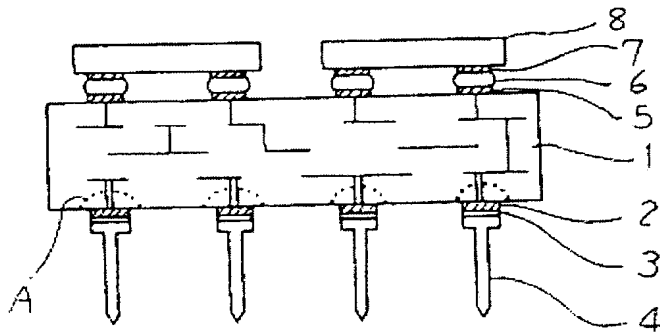
Fig. 1 is a cross sectional view of the multilayer ceramic circuit board having I/O pin of this invention.

Fig. 2 is a cross sectional view of the multilayer ceramic circuit board having a conventional I/O pin.

1: glass ceramic layer, 10: glass ceramic layer added Sic whisker, 4: I/O pin, 8: IC chip



第 1 図



第 2 図